

Amendments to the Claims

The claims have been amended as follows. Underlines indicate insertions and ~~strikeouts~~ indicate deletions.

1. (currently amended) A deposition method comprising:
at a first temperature, contacting a substrate with a surface activation agent and
adsorbing a first layer over the substrate; and
at a second temperature greater than the first temperature, contacting the first
layer with a first precursor gas and also chemisorbing some of the first precursor gas
into a second layer at least one monolayer thick over the substrate.
2. (original) The deposition method of claim 1 wherein the first layer
enhances a chemisorption rate of the first precursor compared to the substrate without
the surface activation agent adsorbed thereon.
3. (original) The deposition method of claim 1 wherein the surface activation
agent comprises a metal halide, metal organic, alcohol, carboxylic acid, or amine.
4. (original) The deposition method of claim 1 wherein the surface activation
agent comprises at least one of $TiCl_4$, WF_6 , hexamethyldisilazane,
tetrakis(dimethylamido)titanium, tetraethylorthosilicate, H_2O , methanol, ethanol,
isopropanol, formic acid, acetic acid, oxalic acid, NH_3 , methylamine, ethylamine, or
dimethylamine.

5. (original) The deposition method of claim 1 wherein the first temperature is less than a chemisorption temperature of the surface activation agent on the substrate.

6. (original) The deposition method of claim 1 wherein the first and second temperatures are those of at least a portion of the substrate.

7. (original) The deposition method of claim 1 wherein the first and second temperatures are those of an outermost surface of the substrate.

8. (original) The deposition method of claim 1 wherein the first and second temperatures are respectively those of the surface activation agent and first precursor.

9. (original) The deposition method of claim 1 wherein the substrate comprises a bulk semiconductor wafer.

10. (original) The deposition method of claim 1 wherein the second layer is chemisorbed on the first layer.

11. (original) The deposition method of claim 1 wherein the contacting the substrate comprises contacting a previously chemisorbed layer of a deposition precursor and adsorbing the surface activation agent on the previously chemisorbed layer.

12. (original) The deposition method of claim 1 further comprising substantially displacing the first layer from over the substrate during the chemisorbing the second layer.

13. (original) The deposition method of claim 1 wherein the surface activation agent is the same as the first precursor.

14. (original) The deposition method of claim 1 wherein the second layer consists essentially of a monolayer.

15. (original) The deposition method of claim 1 wherein the first precursor consists essentially of a single precursor species.

16. (original) The deposition method of claim 1 further comprising contacting the second layer with a second precursor and chemisorbing a third layer at least one monolayer thick on the second layer, forming a chemisorption product of the first and second precursors comprising a deposition material.

17. (original) The deposition method of claim 16 wherein the chemisorption product consists essentially of a monolayer of the deposition material.

18. (currently amended) A deposition method comprising:
at an initial temperature less than a chemisorption temperature of a surface activation agent, adsorbing the agent over a substrate; and
at a deposition temperature greater than the initial temperature, atomic layer depositing a first species over the substrate from a precursor gas.

19. (original) The deposition method of claim 18 wherein the surface activation agent enhances an atomic layer deposition rate of the first species compared to the substrate without the surface activation agent adsorbed thereon.

20. (original) The deposition method of claim 18 wherein the surface activation agent comprises a metal halide, metal organic, alcohol, carboxylic acid, or amine.

21. (original) The deposition method of claim 18 wherein the surface activation agent comprises at least one of $TiCl_4$, WF_6 , hexamethyldisilazane, tetrakis(dimethylamido)titanium, tetraethylorthosilicate, H_2O , methanol, ethanol, isopropanol, formic acid, acetic acid, oxalic acid, NH_3 , methylamine, ethylamine, or dimethylamine.

22. (original) The deposition method of claim 18 wherein the surface activation agent is the same as the first species.

23. (original) The deposition method of claim 18 wherein the initial and deposition temperatures are those of at least a portion of the substrate.

24. (original) The deposition method of claim 18 further comprising substantially displacing the surface activation agent from over the substrate during the atomic layer depositing the first species.

25. (original) The deposition method of claim 18 further comprising atomic layer depositing a second species on the atomic layer deposited first species, the deposited first and second species combined comprising a deposition material.

26. (currently amended) A deposition method comprising:
adsorbing a surface activation agent over a substrate, during the adsorbing at least an outer surface of the substrate being at a first temperature less than a chemisorption temperature of the agent;
altering a temperature of at least a portion of the substrate;
chemisorbing a monolayer of a first compound over the substrate from a precursor gas, during the first compound chemisorbing at least an outer surface of the substrate being at a second temperature greater than the first temperature, and substantially displacing the agent from over the substrate; and
chemisorbing a monolayer of a second compound on the first compound monolayer.

27. (original) The deposition method of claim 26 wherein the adsorbed surface activation agent enhances a chemisorption rate of the first compound compared to the substrate without the surface activation agent adsorbed thereon.

28. (original) The deposition method of claim 26 wherein the surface activation agent comprises a metal halide, metal organic, alcohol, carboxylic acid, or amine.

29. (original) The deposition method of claim 26 wherein the surface activation agent comprises at least one of $TiCl_4$, WF_6 , hexamethyldisilazane, tetrakis(dimethylamido)titanium, tetraethylorthosilicate, H_2O , methanol, ethanol, isopropanol, formic acid, acetic acid, oxalic acid, NH_3 , methylamine, ethylamine, or dimethylamine.

30. (original) The deposition method of claim 26 wherein the surface activation agent is the same as the first compound.

31. (currently amended) A deposition method comprising:

contacting a bulk semiconductor wafer with a cooling medium to establish at least an outer surface of the wafer at an initial temperature;

contacting the wafer with a surface activation agent and adsorbing a first layer on the wafer, the initial temperature being less than a chemisorption temperature of the agent;

placing the wafer on a heated wafer chuck and establishing at least the outer surface of the wafer at a deposition temperature greater than the initial temperature;

and,

at the deposition temperature, contacting the first layer with a deposition precursor gas and chemisorbing a second layer at least one monolayer thick over the wafer.

32. (original) The deposition method of claim 31 wherein the contacting with the cooling medium comprises elevating the wafer over the heated wafer chuck and contacting the wafer with cooling gases and wherein the placing the wafer comprises lowering the wafer onto the heated wafer chuck.

33. (original) The deposition method of claim 31 wherein the contacting with the cooling medium comprises placing the wafer on a cooled wafer chuck different from the heated wafer chuck.

34. (original) The deposition method of claim 31 wherein the contacting with the surface activation agent and deposition precursor comprises moving the wafer within a single chamber of a deposition apparatus from a first zone containing the surface activation agent to a second zone containing the deposition precursor.

35. (original) The deposition method of claim 34 wherein the moving is accomplished by linear translational motion of the heated wafer chuck.

36. (original) The deposition method of claim 31 wherein the contacting with the surface activation agent and deposition precursor comprises moving the wafer from a cooled wafer chuck in a first chamber of a multiple chamber deposition apparatus to a second chamber of the apparatus wherein contacting with the agent and contacting with the precursor may occur.

37. (original) The deposition method of claim 36 wherein the moving is accomplished by a robotic wafer handler.

38. (original) The deposition method of claim 31 wherein the first layer enhances a chemisorption rate of the deposition precursor compared to the wafer without the surface activation agent adsorbed thereon.

39. (original) The deposition method of claim 31 wherein the surface activation agent comprises a metal halide, metal organic, alcohol, carboxylic acid, or amine.

40. (original) The deposition method of claim 31 wherein the surface activation agent comprises at least one of $TiCl_4$, WF_6 , hexamethyldisilazane, tetrakis(dimethylamido)titanium, tetraethylorthosilicate, H_2O , methanol, ethanol, isopropanol, formic acid, acetic acid, oxalic acid, NH_3 , methylamine, ethylamine, or dimethylamine.

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41. (original) The deposition method of claim 31 wherein the surface activation agent is the same as the deposition precursor.

42. (original) The deposition method of claim 31 wherein the second layer consists essentially of a monolayer.

43. (original) The deposition method of claim 31 wherein the deposition precursor consists essentially of a single precursor species.

Claims 44-54 (cancelled).

55. (previously added) A deposition method comprising:

at a first temperature, contacting a substrate with a surface activation agent and adsorbing a first layer over the substrate, the first temperature being less than a chemisorption temperature of the surface activation agent on the substrate;

at a second temperature greater than the first temperature, contacting the first layer with a first precursor and chemisorbing a second layer consisting essentially of a monolayer on the first layer, the first layer enhancing a chemisorption rate of the first precursor compared to an otherwise identical substrate without the surface activation agent adsorbed thereon; and

contacting the second layer with a second precursor, chemisorbing a third layer at least one monolayer thick on the second layer, and forming a chemisorption product of the first and second precursors, the chemisorption product consisting essentially of a monolayer of a deposition material.

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56. (previously added) A deposition method comprising:

at a first temperature, contacting a substrate with a surface activation agent and adsorbing a first layer over the substrate, the first temperature being less than a chemisorption temperature of the surface activation agent on the substrate;

at a second temperature greater than the first temperature, contacting the first layer with a first precursor and chemisorbing a second layer consisting essentially of a monolayer substantially displacing the first layer from over the substrate during the chemisorbing the second layer, the first layer enhancing a chemisorption rate of the first precursor compared to an otherwise identical substrate without the surface activation agent adsorbed thereon; and

contacting the second layer with a second precursor, chemisorbing a third layer at least one monolayer thick on the second layer; and forming a chemisorption product of the first and second precursors, the chemisorption product consisting essentially of a monolayer of a deposition material.

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